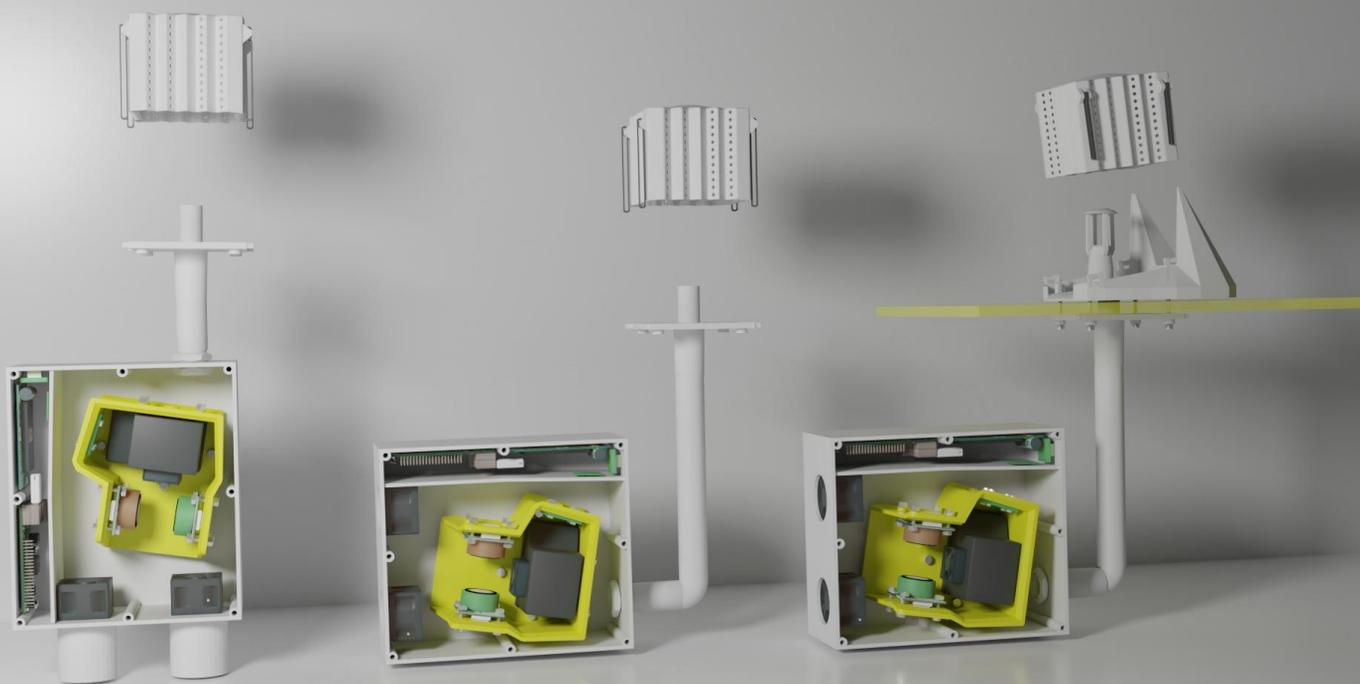


ExpoLIS

Assessment of Human Exposure to Air Pollution
to Change the Way People Move in cities

Newsletter 5

February 2021



Welcome to the fifth edition of the ExpoLIS Newsletter!

This newsletter is based on the ExpoLIS project. This and the future editions will aim to present the work that has been developed, the main outputs and dissemination activities.



In 2018, two partners joined to propose a new project to the Portuguese Foundation for Science and Technology (FCT). In the last years there has been an improvement in Air Quality in urban areas due to the latest emission control strategies. However, the citizens are still exposed to levels of air pollution above the limits imposed by the legislation. The ExpoLIS project was created with the objective of developing a system that will characterize Air Quality, support air pollution improvement measures and ultimately decrease the citizens exposure to air pollutants.

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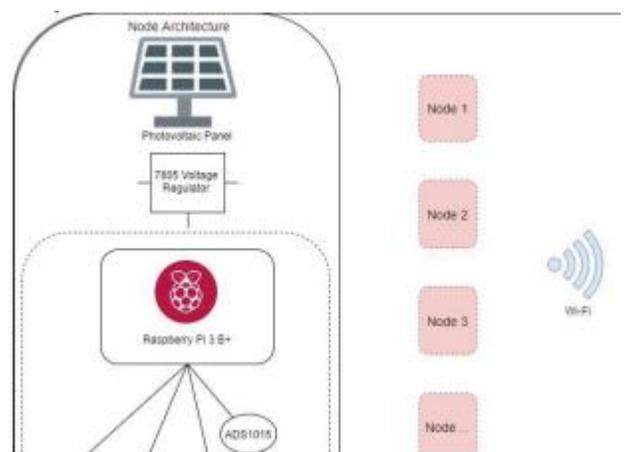
ExpoLIS in the 2020 International Conference and Exposition on Electrical and Power Engineering

The 11th International Conference and Exposition on Electrical and Power Engineering is an important event in the electrical engineering area and in 2020 was held in Romania.

The ExpoLIS team was present and the project was presented through a conference paper and an oral presentation. Pedro Santana presented a work entitled “Environmental pollution monitoring based on sensor network and open software hardware”.

The work presented in the conference paper presented the ExpoLIS sensor network developed to perform air pollution measurements in Lisbon.

The quality of life in big cities is affected by different pollutants caused by human activities. To improve the environmental quality, continuous pollution monitoring is considered, which represents a crucial factor associated with the future decision regarding mobility in the city and activities localization. The paper presents a low-cost sensors network associated with pollution measurement in Lisbon. The monitoring system includes a set of sensors such as gas sensor, a temperature, humidity and pressure sensor, and a dust sensor. The localization of the environment measurement sites is carried out using a GPS module. The system prototype can be placed on buses or other vehicles for a distributed measurement in a specific region of the city. The autonomy of the system is assured through the usage of photovoltaic panels, which provide clean energy. The user accesses the information from the sensors through a web application. It also enables the consultation of a Heat Map with red, yellow, and green zones according to pollution levels. Related to the mobility and pollution level in the city, the application includes a specific functionality that allows creating a route with a starting point and endpoint specified by the user to avoid high polluted regions between two locations of the city. Experimental tests were performed regarding system autonomy, and a set of measurements was carried out mounting the system on an electric bike that traveled around the city of Lisbon.



Read the complete article here:

<https://doi.org/10.1109/EPE50722.2020.9305639>

ExpoLIS in the 5th International Conference on Smart and Sustainable Technologies

The 5th International Conference on Smart and Sustainable Technologies joined experts from both academia and industry in Croatia.

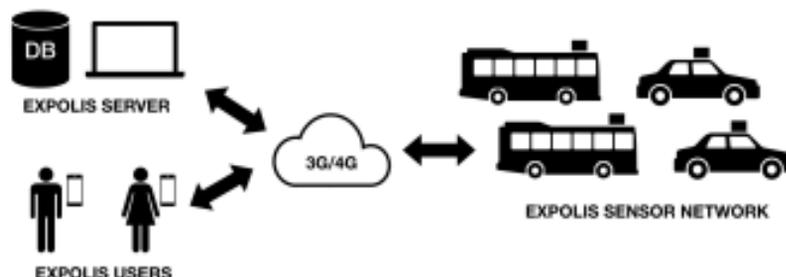
The ExpoLIS team was present and the project was presented through two conference papers and two oral presentations. Pedro Mariano presented the work “Pollution prediction model using data collected by a mobile sensor network”, and Pedro Santana presented the work “An affordable vehicle mounted sensor solution for mobile air quality monitoring”. In this paper work we investigated how to build a model to predict pollution levels using geographical information.

Pollution prediction model using data collected by a mobile sensor network

In this work we investigate how to build a model to predict pollution levels using geographical information. By focusing on this kind of attributes we hope to contribute to an effective city management as we will find the urban configurations that conduct to the lowest pollution levels. We used decision trees to build a regression model. We performed a parameter grid search using cross validation. Ablation analysis where some attributes were removed from training showed that geographical based attributes impact the prediction error of decision trees.

An affordable vehicle mounted sensor solution for mobile air quality monitoring

This work presented the first prototype of the ExpoLIS system and its preliminary laboratory and field experiments. The ExpoLIS system is composed of an affordable vehicle mounted mobile sensor network and its supporting user-centred services whose aim is to provide citizens with real-time and dense spatiotemporal air quality data. A set of preliminary static laboratory experiments and dynamic field experiments were conducted, showing that the current prototype is already able to track changes in the air quality and provide citizens with access to these events via a mobile application.



Read the complete articles here:

<https://doi.org/10.23919/SpliTech49282.2020.9243844>

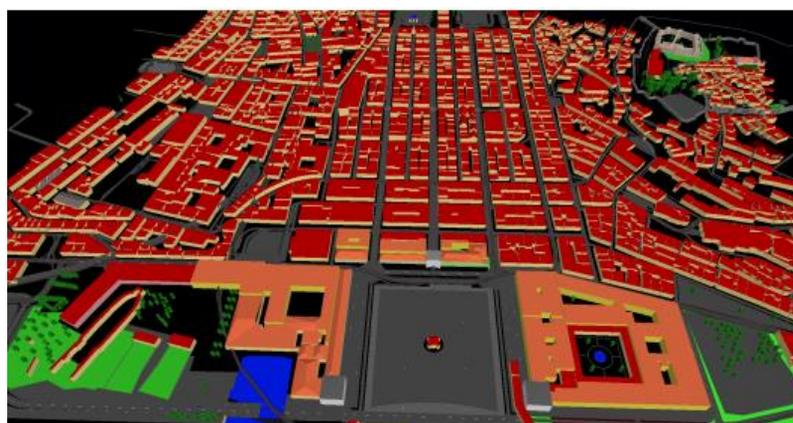
<https://doi.org/10.23919/SpliTech49282.2020.9243697>

Game-Like 3D Visualisation of Air Quality Data

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The data produced by sensor networks for urban air quality monitoring is becoming a valuable asset for informed health-aware human activity planning. However, in order to properly explore and exploit these data, citizens need intuitive and effective ways of interacting with it.

The ExpoLIS project presents CityOnStats, a visualisation tool developed to provide users, mainly adults and young adults, with a game-like 3D environment populated with air quality sensing data, as an alternative to the traditionally passive visualisation techniques. CityOnStats provides several visual cues of pollution presence with the purpose of meeting each user's preferences. Usability tests with a sample of 30 participants have shown the value of air quality 3D game-based visualisation and have provided empirical support for which visual cues are most adequate for the task at hand.

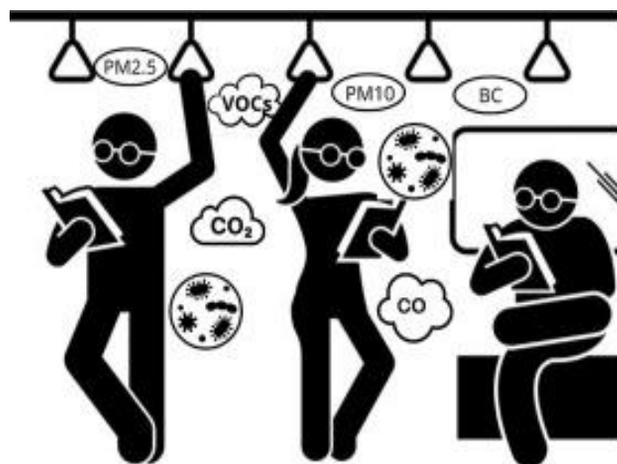


Read the complete article here:

<https://doi.org/10.3390/mti4030054>

Factors affecting the exposure to physicochemical and microbiological pollutants in vehicle cabins while commuting in Lisbon

Commuters are exposed to a variety of physicochemical and microbiological pollutants that can lead to adverse health effects. The ExpoLIS project evaluates the indoor air quality (IAQ) in cars, buses and trains in Lisbon, to estimate inhaled doses while commuting and to evaluate the impacts of cleaning and ventilation on the IAQ. Particulate matter with diameter lower than 1, 2.5 and 10 μm (PM1, PM2.5 and PM10), black carbon (BC), carbon monoxide (CO), carbon dioxide (CO_2) volatile organic compounds (VOCs), formaldehyde (CH_2O) and total airborne bacteria and fungi were measured and bacterial isolates were identified. Results showed that the type of ventilation is the main factor affecting the IAQ in vehicle cabins. Under the fan off condition, the concentration of BC was lower, but the concentration of gases such as CO_2 , CO and VOC tended to accumulate rapidly. When the ventilation was used, the coarse particles were filtered originating the decrease of indoor concentrations. Commuters travelling in trains received the lowest dose for all chemical pollutants, except VOC, mainly because railways are further away from the direct vehicular emissions. Commuters travelling in cars without ventilation received the highest inhaled dose for almost all pollutants despite having the lowest travel duration. Airborne microbiota was highly affected by the occupancy of the vehicles and therefore, the fungi and bacterial loads were higher in trains and buses. Most of the isolated species were human associated bacteria and some of the most abundant species have been linked to respiratory tract infections.



Read the complete article here:

<https://doi.org/10.1016/j.envpol.2020.116062>

Events with students

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The ExpoLIS research oriented towards the use of IoT solutions in solving emerging societal challenges has provided university students, involved in the project activities, access to an experimental and updated teaching that has facilitated their insertion in the job market.

Several BSc, MSc and PhD students have been involved in the ExpoLIS activities. In the recent months, ExpoLIS was presented in Air Quality Management classes at Instituto Superior Técnico and Escola Superior de Tecnologias da Saúde and in CARISMA Summer School at CTN, Instituto Superior Técnico, University of Lisbon.

The European Night of Researchers it's an initiative that aims at bringing together researchers and the community. The ExpoLIS project was present in the 2019 edition and the citizens could learn about the objectives of the project and how it is being implemented in Lisbon.



ExpoLIS in the European Night of Researchers 2019 and in the Ecology Day 2019

The European Night of Researchers it's an initiative that aims at bringing together researchers and the community. The ExpoLIS project was present in the 2019 edition and the citizens could learn about what is the project and how is it being implemented in Lisbon.



ExpoLIS was also present in the Webinar “How to improve the air we breath”, an initiative promoted on the Ecology Day to all the community.



Meet the team

Pedro Mariano

Pedro Mariano is a researcher at IST. His research interests are focused on the application of techniques from machine learning to the generic game playing field and to the classification of real world data.



What will you find in the next issue?

-  The ExpoLIS sensor node prototype: what has changed?
-  Chemical characterization of particulate matter in urban transport modes
-  Meet the team: Vânia Martins

Keep in touch!



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